STEAM EXPLOSION : PROCESS AND IMPACT ON LIGNOCELLULOSIC MATERIAL

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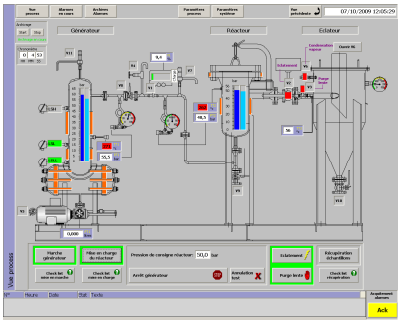
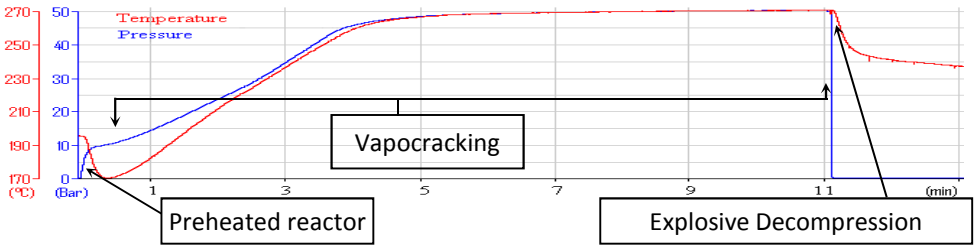
ABSTRACT

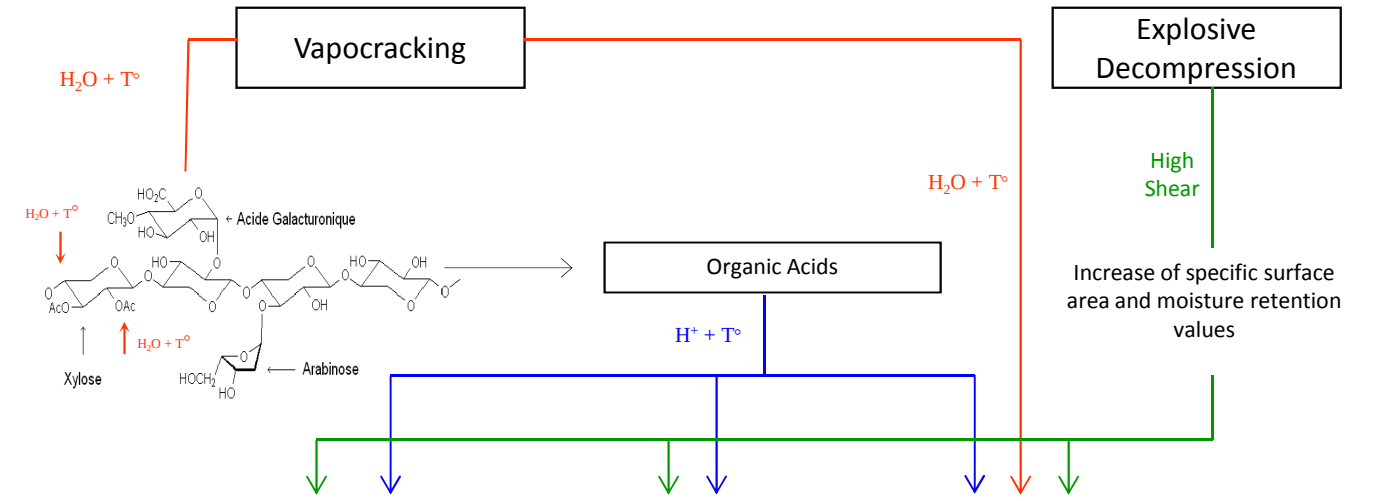
Steam explosion is a thermomechanochemical process which allows the breakdown of lignocellulosic structural components by steam heating, hydrolysis of glycosidic bonds by organic acid formed during the process and shearing forces due to the expansion of the moisture. The process is composed of two distinct stages: vapocracking and explosive decompression. Cumul effects of both phases include modification of the physical properties of the material (specific surface area, water retention capacities, color, cellulose crystallinity rate,…), hydrolysis of hemicellulosic components (mono and oligosaccharides released) and modification of the chemical structure of lignin. These effects permit the opening of lignocellulosic structures and increase the enzymatic hydrolysis rate of cellulose components in the aim to obtain fermentable sugars used in second generation biofuels process.

PILOT PLANT AND PROCESS





IMPACT ON LIGNOCELLULOSIC MATERIAL



- Hydrolysis of hemicellulosic fraction in oligosaccharides (under medium treatment intensities : 20 bars 1 min) or monosaccharides under higher treatment intensities

- Organic acids induce formation of carbonium ions on benzylic alcool which lead to :

A) Breaking β-O-4 links and induce depolymérisation
B) Reacted with C2 et C6 and conduct to a partial repolymerisation

=> Partial extraction and modification of the chemical structure of the lignin

- Partial hydrolysis of cellulosic fraction under high treatment intensities

- Impact on the ratio of cellulose I / Cellulose II => Modification of the cellulose crystallinity

- Increase of the overall accessibility of cellulose fiber